Frontiers of New Light Sources Applied to Materials, Interfaces, and Processing Focus Topic
Room A210 - Session LS+AC+NS-ThA

Photon Science for Imaging Materials from the Meso- to the Nanoscale

Moderator: Maya Kiskinova, Elettra-Sincrotrone Trieste, Italy

2:20pm **LS+AC+NS-ThA1 Triplet Dynamics in Photovoltaic Materials Measured with Time Resolved X-Ray Spectroscopies***, R. Costantini,* University of Trieste*; R. Faber,* Technical University of Denmark*; A. Cossaro, A. Verdini, L. Floreano,* CNR - Istituto Officine Materiali*; C. Haettig,* Ruhr-University Bochum, Germany*; A. Morgante,* University of Trieste, Italy*; S. Coriani,* Technical University of Denmark*; **Martina Dell'Angela**,* CNR - Istituto Officine Materiali, Italy **INVITED**

Singlet exciton fission (SF) is a multiexciton generation process in organic molecules, where an optically excited singlet exciton is converted into two triplet excitons. The exploitation of this mechanism has been shown capable of boosting the efficiency of solar energy conversion, and it has been proposed as a mean for exceeding the Shockley-Queisser limit of efficiency of solar cells. In the last decade, several studies have investigated different chromophores to identify the ones suitable to produce high yield SF and long living triplets. Such studies spanned from the fundamental to the applicative approach, also dealing with the optimization of the interfaces with the other materials in the device in order to achieve an overall increased efficiency of the charge transport. In particular, the study of the dynamics of the triplet states, when formed and transported across all the interfaces, is crucial for modelling the charge transport properties in a working device. Here we present a new experimental approach to measure the triplet dynamics at the picosecond timescale, that uses the advantage of chemical sensitivity with respect to conventional optical techniques, thus offering the possibility of tracking the dynamics of the triplet states across different materials. We exploit the chemical selectivity of X-ray absorption spectroscopy (XAS) in an optical pump/X-ray probe experiment at a pump-probe setup that we developed at the Elettra synchrotron and with the support of novel implemented calculation methodologies. We studied triplet dynamics in pentacene thin films (the prototypical singlet fission material) with lifetime of about 300ps.

3:00pm **LS+AC+NS-ThA3 Synchrotron X-Ray Tomography to Understand Structure and Physical Transformations in Solid State Batteries***, **Kelsy Hatzell**, M.B. Dixit,* Vanderbilt University **INVITED**

The increasing demand for portable electronics, stationary storage, and electric vehicles is driving innovation in high-energy density batteries. Solid electrolytes that are strong enough to impede lithium dendrite growth may enable energy dense lithium metal anodes. Currently, the power densities of all-solid state batteries is limited because of ineffective ion transport and chemical and physical decomposition at solid|solid interfaces. The nature of ionic transport at intrinsic and extrinsic interfaces is important for mitigating chemical and structural instabilities. Extrinsic interface instabilities are responsible for high interfacial resistances. In order to displace liquid electrolytes, new materials and engineering strategies need to be developed to negate these degradation pathways. New insight into the governing physics that occurs at these interfaces are critical for developing engineering strategies for the next generation of energy dense batteries [1,2]. However, buried solid|solid interfaces are notoriously difficult to observe with traditional bench-top and lab-scale experiments. In this talk I discuss opportunities for tracking phenomena and mechanisms in all solid state batteries *in-situ* using advanced synchrotron techniques. Synchrotron techniques that combine reciprocal and real space techniques are best equipped to track relevant phenomena with adequate spatial and temporal resolutions.

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